JFK Bibliography

In the thirty-one years since JFK's assassination, a veritable flood of books relating to the crime have appeared, ranging from apologias for the Warren Commission, to eloquent damnations of same. The Bibliography presented here is not comprehensive; really it's just of list of most of the books those of us at Fair Play have read on the subject, with short descriptions of each. The presence of a book on this list does not necessarily constitute an endorsement of that particular work.

The listings here are alphabetical by title.

Accessories After the Fact, by Sylvia Meagher

1967. A meticulous analysis of the Warren Commission Report. Meagher was in the second wave of Warren, critics, and her book is probably the best of its time. While Accessories is now a little dated, it remains a strong indictment of the Warren Commission and an extremely valuable work. Meagher also researched and published the Subject Index to the Report and Hearings and Exhibits of the Warren Commission, and a Master Index with Gary Owens that also covers HSCA material.

Act of Treason, by Mark North

1992. This book argues that Kennedy was killed by the Marcello crime syndicate, and that J. Edgar Hoover learned of the plot but did nothing to prevent it.

After the Assassination: A Positive Appraisal of the Warren Report, by John Sparrow

1987. This thin volume by a renowned professor proves that academic qualifications are no substitute for knowledge of the documents. (From David R. Wrone's The Assassination of John Fitzgerald Kennedy: An Annotated Bibliography.)

The Assassinations: Dallas and Beyond, edited by Paul Hoch, Peter Dale Scott, and Russell Stetler 1976. A collection of essays on different aspects of the JFK assassination, both pro-conspiracy and con. Also includes sections on the slayings of Robert Kennedy and Martin Luther King, with a section on Arthur Bremer (George Wallace's assailant) thrown in for good measure.

The Assassins, by John Kaplan

1967. Kaplan's magazine article first appeared in *The American Scholar*. It is an error-ridden and emotionally suffused attempt by a law professor to attack critics of the Warren Commission findings who he sees as assassing of truth. Why this article would establish Kaplan, as it did, as a national authority on the Warren Commission is incomprehensible. (From David R. Wrone's *The Assassination of John Fitzgerald Kennedy: An Annotated Bibliography.*)

Best Evidence, by David Lifton

1980. One of the more controversial books on the assassination. In brief, it is Lifton's thesis that Kennedy's body was hijacked by unknown conspirators between Dallas and Bethesda Naval Hospital on November 22, 1963, and surgically aftered so it would support the lone gunman theory.

Betrayal, by Robert D. Morrow

1976. Former CIA contract employee Robert Morrow details (in semi-fictionalized form) his involvement with several key events in the secret war against Castro, including the ill-fated Bay of Pigs invasion and a government-sanctioned counterfeiting operation designed to destablize the Cuban economy. He describes the procurement of rifles and specialized communication gear that was later used, he claims, in the JFK assassination.

Case Closed, by Gerald Poener

1993. Posner's book was a boon to Warren supporters when it appeared during the summer of 1993. The former wall street lawyer ties the JFK case into a nice little package. A good half of this book is devoted to the life of Lee Oswald. Posner got great publicity from the mainstream press, but has been largely discredited as far as most

serious researchers are concerned. He remains something of a hero to Warren diehards.

Case Open, by Harold Weisberg

1994. This entry by Harold Weisberg is an answer to Gerald Posner's Case Closed. Like all of Weisberg's published writing, Case Open is difficult to read, being replete with convoluted sentences that sometimes require several passes. Then there is the author's open contempt for his subject, expressed in such memorable phrases as "kissers of official ass like Posner." Case Open may not be the best antidote to Case Closed, but it will do for now.

A Citizen's Dissent, by Mark Lane

1968. A follow-up to Rush to Judgement. Lane describes his efforts to publicize his findings in the Kennedy case, in the face of official disdain. Some interesting minutia.

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1992: A book looking at various conspiracy theories, and on a grand scale. Does anything ever happen that is not a conspiracy? This book is actually an interesting look at conspiracies and those who believe in them, and not an endorsement of any particular mindset; regarding Kennedy, it contains (among other things) some interesting information on Kerry Thomley. Thomley was Lee Oswald's "Marine buddy" and himself a budding author at the time of the assassination. He actually wrote a book (unpublished) inspired in part by Oswald, before the assassination (!!) and another one (published) after it, the latter entitled Oswald.

Conepiracy, by Anthony Summers

A comprehensive study of the case, first published in 1980, and updated several times. The 1992 edition contains a preface written during the publicity leading up to Oliver Stone's *JFK*; the author is not a Stone booster. Summers' book is a dispassionate examination of the assassination and its aftermath. While by no means conclusive, *Conspiracy* points to the strong possibility that the crime was planned by renegade CIA types (including, perhaps, William Harvey) and carried out by members of organized crime, with Lee Harvey Oswald as designated fall guy. Lots of compelling information on the mysterious "Maurice Bishop," especially in the latest edition.

Conspiracy of One, by Jim Moore

1989. A latter-day Scavengers and Critics. Moore's book is another apology for the Warren Commission, but it's not worth the paper it's printed on. Someone had the gall to subtitle this nasty little volume "The definitive book on the assassination," but the first edition didn't even have an index. A 1992 paperback edition added one.

Conspiracy of Silence, by Dr Charles Crenshaw

1992. Crenshaw was one of the doctors in Parkland Hospital involved in the desperate attempts to save JFK. He says in his book that the Parkland doctors tacitly agreed to a "conspiracy of silence"...that is, to not talk about the fact Kennedy's body had wounds obviously inflicted from a gunman firing from the front.

Contract on America, by David E. Schiem

1988. This work by David Scheim details the alleged involvement of organized crime in the killing of JFK, in particular New Orleans mobster Carlos Marcello. Schiem's research into the pre-assassination behavior of Jack Ruby and others is engrossing. From his detailed rundown of suspicious Jack Ruby phone calls, to the strange intertwining of David Ferrie and Marcello, Schiem makes a pretty good case. But curiously absent from this work is any mention of the intelligence agencies. Schiem is on the board of James Lesar's Assassination Archives Research Center in Washington D.C.

Coup d' Etat in America, by Michael Canfield and A. J. Weberman

1975, reissued in 1992. What Coup d' Etat in America does more than anything else is provide an in-depth look at the links between the Watergate affair and the JFK assassination. The authors use photographs with acetate overlays to demonstrate that E. Howard Hunt and Frank Sturgis may have been in Dealey Plaza macquerading as homeless men. Canfield's bizarre interview with Sturgis and Weberman's insights into super-mercenary Gerry Patrick Hemming round out a tantalizing book replete with details and documentation. Also included are aspects of Silvio Odio as well as a good case for Oswald's affiliation with the CIA. The reissued version contains new information, including E. Howard Hunt's libel suit for twelve million dollars against the authors.

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end system, even if communication data is transmitted during a period of time until path information is updated by a routing protocol and an error is caused due to a path fault, a period of time that is required until a new path is selected and communication is started is shorten.

According to the invention, there is provided a communication system in which a connection via a plurality of relay apparatuses is established between an end system on the communicating source side and an end system on the communicating destination side and data is communicated, wherein each relay apparatus has: a connection negative response unit which, when an error of a next relay destination is detected at the time of reception of a connection establishment request, refuses the connection establishment request and transmits a negative response to the relay source; and a negative response relay unit which, when the negative response is received from the relay destination, transmits the received negative response to the relay source. The end system of the communicating source has a connection establishment requesting unit which, when the negative response is received from the relay destination after the transmission of the connection establishment request, retransmits a connection establishment request which selects another relay destination without notifying the

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application of a failure of the connection establishment, thereby establishing a connection to the communicating destination end system by another path. Therefore, even if the establishment of the connection fails due to the path fault, the failure is not notified to the application, the connection via another relay apparatus is immediately established from the communicating source end system, and it is unnecessary to retransmit the communicating request from the application. A connection to the partner destination end system in which the fault path is avoided is established in a short time, so that a delay of communication (business) can be avoided. When the path fault is detected upon establishment of the connection, a connection via a new communication path can be established in a real-time manner. Therefore, even when a large-scale multiplexed network such as Internet, provider, or the like is switched, it is unnecessary to monitor a fault to the end system. Further, since only a packet which is used for communication is used, a special mechanism for the fault monitor such as "ping" is not needed. Naturally, the mechanism for the fault monitor such as "ping" can be also used in parallel.

25 The end system of the communicating source has a plurality of relay apparatuses as a plurality of relay destinations. When a negative response is received

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after a specific relay apparatus is selected and a connection establishment request is transmitted, the end system selects another relay apparatus and retransmits the connection establishment request. end system of the communicating source has a plurality of relay adapters which are provided as a plurality of relay destinations for one relay apparatus. negative response is received after a specific relay adaptor is selected and the connection establishment request is transmitted, the end system can select another relay adaptor and retransmit the connection establishment request. According to the invention, as mentioned above, fundamentally, a plurality of relay destinations are provided for the communicating source end system, in response to the negative response which is returned due to the path fault, another relay destination is selected by the communicating source end system, and the connection establishment request is retransmitted. Further, in response to the negative response at a stage of the relay apparatus at the halfway, it is also possible to select another relay destination and retransmit the connection establishment That is, the relay apparatus is equipped with request. a relay selecting unit which, when the negative response is received from the relay destination after completion of the relay of the connection establishment request, retransmits the connection establishment

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request in which another relay destination has been selected, and establishes a connection to the communicating destination end system by another path. The relay apparatus has a plurality of adapters which are provided as a plurality of relay destinations for one relay apparatus. When the negative response is received after a specific relay adaptor is selected and the connection establishment request is transmitted, the relay apparatus can select another relay adapter and retransmit the connection establishment request. As mentioned above, in response to the negative response returned due to the path fault, the connection establishment request in which another relay destination has been selected is retransmitted at the stage of the relay apparatus having a plurality of relay destinations at the halfway of the network, thereby establishing the connection to the communicating destination end system by another path. Consequently, such troublesomeness that the negative response is returned to the end system of the communicating source and another relay destination is selected is swept away and, further, the communication can be started in a short time. In case of the TCP/IP protocol, each of the end systems and relay apparatuses in the communication system of the invention switches the communication paths by 4-layer switches for establishing a TCP connection. The negative response

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unit of the relay apparatus stores refusal reasons and information of the location of the fault occurrence relay apparatus into an optional area or a user data area of a negative response packet and transmits the packet to the relay source. From the contents of the negative response packet, the end system can recognize in which relay apparatus the connection is refused and When the negative response packet is for what reasons. received, the connection establishment requesting unit of the communicating source end system changes the status of the relay destination where the fault path was caused into an unusable state, after that, selects another relay destination, and retransmits the connection connecting request. As mentioned above, by combining with the fault monitor, wasteful retransmission or connection delay can be avoided with respect to the communication which was caused during a period of time until an error can be detected by the In this instance, the location fault monitor. information of the abnormal relay apparatus which is stored in the negative response packet includes an IP address of the abnormal relay apparatus and the number of hopping times indicative of the number of normal relay apparatuses to the abnormal apparatus. negative response relay unit of the relay apparatus can further store the self IP address into the optional area or user data area of the negative response packet

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and transmit the packet to the relay source.

Consequently, the relay apparatuses existing on the path to the abnormal relay apparatus can be recognized.

According to the invention, a relay apparatus itself for establishing a connection between an end system of the communicating source and an end system of the communicating destination and communicating data is The relay apparatus comprises: a connection provided. negative response unit which, when an error of a relay destination is detected upon reception of a connection establishment request, refuses the connection establishment request and transmits a negative response to a relay source; and a negative response relay unit which, when the negative response is received from the relay destination, transmits the received negative response to the relay source. The negative response unit of the relay apparatus stores refusal reasons, an IP address of the abnormal relay apparatus indicative of a position of a fault occurrence relay apparatus, and the number of hopping times indicative of the number of normal relay apparatuses to the abnormal relay apparatus into an optional portion or a user data area of a negative response packet and transmits them to the relay source.

According to the invention, an end system for establishing a connection via a plurality of relay apparatuses and communicating data is provided. The

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end system comprises: an application which issues a communicating request to a specific end system as a partner destination; and a connection establishment requesting unit which, when a negative response is received from a relay destination after transmission of a connection establishment request based on the communicating request, retransmits the connection establishment request in which another relay destination has been selected and establishes a connection to a communicating destination end system by another path without notifying an application of a connection establishment failure. When the negative response packet is received, the connection establishment requesting unit of the end system changes the status of the relay destination where the fault path is caused into an unusable state, after that, selects another relay destination, and retransmits the connection connecting request.

provided a communicating method of establishing a connection via a plurality of relay apparatuses between an end system of a communicating source and an end system of a communicating destination and communicating data. According to the communicating method, when an error of the relay destination is detected upon reception of a connection establishment request, one of the relay apparatuses refuses the connection

to the relay source, the relay apparatus which received the negative response from the relay destination transmits the received negative response to the relay source, and when the negative response is received from the relay destination after transmission of the connection establishment request, the end system of the communicating source retransmits the connection establishment request in which another relay destination has been selected and establishes a connection to the communicating destination end system by another path without notifying an application of a connection establishment failure. The details of the communicating method are fundamentally the same as those of the communication system.

The above and other objects, features, and advantages of the present invention will become more apparent from the following detailed description with reference to the drawings.

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BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an explanatory diagram of a network in the first embodiment of the invention in which a connection establishment request is switched in an end system;

Fig. 2 is an explanatory diagram of a layer structure of the end system and relay apparatuses in

Fig. 1;

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Fig. 3 is a block diagram of a functional construction of the end system and the relay apparatuses in Fig. 1;

Fig. 4 is an explanatory diagram of a negative response packet which is transmitted at the time of detection of an error of a relay destination;

Fig. 5 is an explanatory diagram of a switching process according to the first embodiment of Fig. 1;

Figs. 6A, 6B, and 6C are time charts for the switching process in Fig. 5;

Fig. 7 is a flowchart for the processing operation of the end system in Fig. 3;

Fig. 8 is a flowchart for a connection establishing process in Fig. 7;

Fig. 9 is a flowchart for a negative response process in Fig. 7;

Fig. 10 is a flowchart for a relay process by the relay apparatuses in Fig. 3;

Fig. 11 is a flowchart for a connection establishing process in Fig. 10;

Fig. 12 is a flowchart for a negative response process in Fig. 10;

Fig. 13 is an explanatory diagram of a network in
the second embodiment of the invention in case of
switching in a relay apparatus adjacent to an end
system;

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Fig. 14 is an explanatory diagram for the switching process according to the second embodiment in Fig. 13;

Figs. 15A, 15B, and 15C are time charts for the switching process in Fig. 14;

Fig. 16 is an explanatory diagram of a network in the third embodiment of the invention in which a relay apparatus adjacent to an end system has a plurality of adapters;

Fig. 17 is an explanatory diagram of a network in the fourth embodiment of the invention in case of switching in adapters in a relay apparatus adjacent to an end system; and

Fig. 18 is an explanatory diagram of a network in the fifth embodiment of the invention in case of switching in adapters in relay apparatuses adjacent to end systems of a communicating source and a communicating destination.

20 <u>DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS</u>

Fig. 1 shows the first embodiment of a communication system according to the invention and is characterized in that a connection establishment request is switched on the end system side at the time of occurrence of a path fault. A network which constructs the communication system of the invention has an end system (self system) 10 serving as a

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communicating source and an end system (partner destination system) 12 serving as a communicating destination. A large-scale network which is multistage constructed by a plurality of relay apparatuses 14-11 to 14-1n and 14-21 to 14-2n and transmission paths 16 is constructed between the end systems 10 and 12. For example, there is the Internet, Ethernet, or the like as such a network.

Fig. 2 shows a layer structure of the end systems 10 and 12 and the relay apparatuses with respect to the side of the relay apparatuses 14-11 to 14-1n. network corresponds to a TCP/IP protocol. Each of the end systems 10 and 12 and the relay apparatuses 14-11 to 14-1n has a physical layer, a data link layer, an IP layer, and a TCP layer. Further, each of the end systems 10 and 12 has an application layer for performing communication (business) on the TCP layer. Therefore, a network such that a connection via a plurality of relay apparatuses is established between the end system 10 as a communicating source and the end system 12 as a communicating destination and data is communicated according to the invention in Fig. 1 establishes a TCP connection and performs a network switching by 4-layer switches each of which is known as a gateway.

Fig. 3 shows a functional construction of each of the end system 10 and relay apparatus 14-11 extracted

from Fig. 1. The end system 10 comprises an application 18 and a connection establishment requesting unit 20. The application 18 is constructed by application software for executing communication (business) with the end system of the partner 5 destination and exists in an application layer in Fig. The connection establishment requesting unit 20 is 2. arranged in the TCP layer in Fig. 2. communicating request to an arbitrary partner destination end system is received from the application 10 18, the connection establishment requesting unit 20 transmits a connection establishment request packet for establishing a TCP connection, specifically speaking, an SYN packet to, for example, the relay apparatus 14-11 serving as a relay destination through the 15 transmission path 16 in accordance with a routing protocol of TCP/IP. The connection establishment request packet transmitted from the end system 10 to the relay apparatus side as mentioned above establishes a connection by a relay transfer of the connection 20 establishment request packet to the end system 12 via the relay apparatuses 14-11, 14-12, 14-13, and 14-1n, for example, in Fig. 1. When a connection establishment response is derived from the end system 12, data communication from the application 18 is 25 started.

The relay apparatus 14-11 in Fig. 3 has a

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connection relay unit 22, a connection negative response unit 24, and a negative response relay unit When the connection establishment request packet is received from the end system 10 serving as a relay source or from another relay apparatus, the connection relay unit 22 discriminates a status of the next adjacent relay destination and transmits the connection establishment request packet if the status is normal. At this time, the number of hopping times of an optional area or a user area of the connection establishment request packet is counted and transmitted. When the connection establishment request packet is received from the end system 10 or another relay apparatus, the connection negative response unit 24 discriminates a status of the next adjacent relay destination. When the status is abnormal, the connection negative response unit 24 refuses the connection establishment request to the next relay destination and transmits a negative response packet for refusing the establishment of a TCP connection, specifically speaking, an RST packet or an FIN packet to the end system 10 serving as a relay source or another relay apparatus, thereby disconnecting the connection.

The negative response packet which is transmitted by the connection negative response unit 24 has a packet format of Fig. 4. A negative response packet 28

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comprises a header 30 and transfer information 32. header 30 has a construction as a TCP protocol header. Refusal reasons of the TCP connection, location information of the fault occurrence relay apparatus, and the like are stored in the transfer information 32. For example, as shown on the lower side of the diagram, an ID (identification) code 34 indicative of the transfer information, a disconnection reason code 36, a fault occurrence relay apparatus (IP address) 38, and the number of hopping times 40 are stored in the transfer information 32. Subsequently to the number of hopping times 40, IP addresses are sequentially stored as apparatus information of the passage relay apparatuses at the time of relaying the negative response packet 28. Such passage relay apparatus information 42 is selective information and stored as necessary.

Referring again to Fig. 3, when the negative response packet 28 in Fig. 4 which was relayed from another adjacent relay apparatus is received, the negative response relay unit 26 of the relay apparatus 14-11 transmits the negative response packet 28 as it is to the end system 10 serving as a relay source. At this time, as transfer information 32 in Fig. 4, the negative response relay unit 26 can also store the self IP address as passage relay information 42. After the connection establishment requesting unit 20 of the end

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system 10 transmitted the connection establishment request packet to the relay apparatus 14-11 on the basis of a communicating request from the application 18, when the negative response packet is received from the relay apparatus 14-11, the connection establishment requesting unit 20 discriminates whether there is another relay destination or not without notifying the application 18 of the failure of the connection In this case, since the relay apparatus establishment. 14-21 exists as another relay destination, the connection establishment requesting unit 20 again transmits the connection establishment request packet to the relay apparatus 14-21, thereby establishing a connection to the end system 12 of the communicating destination by another path from the relay apparatus 14-21. When the negative response packet is received from the relay apparatus 14-11, the connection establishment requesting unit 20 changes the status of the relay apparatus 14-11 as a relay destination at the time of communication in which the path fault was caused to an unusable state on the basis of the transfer information 32 stored in the optional area or user area in the negative response packet 28 shown in Fig. 4, thereby enabling the relay apparatus 14-21 side which can establish a normal communication path from the beginning to be selected as a relay destination when the communicating request to the same end system

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12 is generated from the application 18 after that.

Fig. 5 is an explanatory diagram of a communicating process in the case where a path fault is caused in response to the connection establishment request and the path is switched on the end system side of the communicating source with respect to the first embodiment of Fig. 1. When the communicating request is issued from the application of the end system 10, the end system 10 transmits the connection establishment request packet to, for example, the adjacent relay apparatus 14-11. The connection establishment request packet is further relayed from the adjacent relay apparatus 14-11 to the relay apparatuses 14-12 and 14-13 at the halfway. Now, assuming that an error occurred in the relay apparatus 14-14 located in front of the end system 12 of the communicating destination, when the relay apparatus 14-13 receives the connection establishment request packet from the relay apparatus 14-12, a status of the relay apparatus 14-14 as a next relay destination is discriminated, so that it is recognized that it is Therefore, the relay apparatus 14-13 which abnormal. detected the error of the next relay destination refuses the establishment of the TCP connection, forms a negative response packet 46 having the format contents of Fig. 4, and transmits it to the relay apparatus 14-12 of the relay source.

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apparatus 14-12 which received the negative response packet 46 does not change the packet contents but adds a self IP address as necessary, thereby transmitting the resultant packet to the one-preceding relay apparatus 14-11 of the relay source. In a manner similar to the above, the relay apparatus 14-11 also transmits the negative response packet 46 to the end system 10 of the communicating source. By this reception, the end system 10 recognizes the occurrence of the path fault due to the error of the relay apparatus 14-14 and discriminates the presence or absence of another relay apparatus having a path other than the fault occurrence path without notifying the application 18 of the failure of the TCP connection establishment. In this case, since the adjacent relay apparatus 14-21 exists as another relay destination, the end system 10 retransmits a connection establishment request packet 48 in which the same end system 12 is set to the communicating destination to the adjacent relay apparatus 14-21. The connection establishment request packet 48 transmitted to the relay apparatus 14-21 is sequentially relayed by the relay apparatuses 14-22, 14-23, and 14-24 at the halfway. After that, it finally reaches the end system Thus, the TCP connection is established with the communicating destination end system 12. By receiving the connection establishment response, the end system

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10 of the communicating source starts the data communication from the application.

Figs. 6A, 6B, and 6C are time charts showing the details of the switching operation on the end system 10 side in Fig. 5. The end system selects the adjacent relay apparatus 14-11 as a relay destination on the basis of the communicating request from the application unit and discriminates the status of the relay apparatus 14-11 in step S1. At this time, since the status of the relay apparatus 14-11 is normal, the connection establishment request packet is transmitted, thereby establishing a connection. If the status is abnormal, another relay apparatus is selected in step The adjacent relay apparatus 14-11 which received the connection establishment request packet from the end system 10 discriminates the status of the next relay apparatus 14-21 serving as a relay destination in In this case, since the relay apparatus 14-21 is normal, the connection establishment request packet is transmitted to the relay apparatus 14-21, thereby establishing a connection. A status of the relay apparatus 14-13 serving as a next relay destination of the relay apparatus 14-21 is discriminated in step S3. Since it is normal in this case, the connection establishment request is similarly issued, thereby establishing a connection. The relay apparatus 14-13 discriminates a status of the relay apparatus 14-14

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serving as a next relay destination and recognizes the occurrence of an error in the relay apparatus 14-14. The processing routine advances to step S5 and the error contents of the relay apparatus 14-14 serving as a relay destination are set into the negative response In step S6, the negative response packet is packet. transmitted to the relay apparatus 14-21 of the relay source, thereby disconnecting the connection. relay apparatus 14-21 which received the negative response packet from the relay apparatus 14-13 discriminates the presence or absence of an alternative relay apparatus to the end system 12 serving as a communicating destination in step S7. Since no alternative relay apparatus exists in this case, whether the transfer information is added or not is discriminated in step S8. If YES, for example, the IP address showing the passage through the relay apparatus 14-21 is added to the negative response packet in step The negative response packet is transmitted to the relay apparatus 14-11 as a relay source, thereby disconnecting the connection. Also in the relay apparatus 14-11, the presence or absence of an alternative relay apparatus to the end system 12 is discriminated in step S10. Since the alternative relay apparatus does not exist in this case either, the presence or absence of the addition of the transfer information is discriminated in step S11. If there is

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the alternative relay apparatus, the self IP address is added in step S12 and, thereafter, the negative response packet is transmitted to the end system 10 serving as a relay source, thereby disconnecting the The end system 10 of the communicating connection. source which received the negative response packet from the adjacent relay apparatus 14-11 discriminates the presence or absence of an alternative relay apparatus to the end system 12 of the communicating destination in step S13. Since there is the alternative relay apparatus 14-21 in this case, step S14 follows. status of the relay apparatus 14-11 upon communication of the end system 12 in which the path fault occurred is changed to the unusable state. After that, the relay apparatus 14-21 as an alternative relay apparatus is selected in step S15 and the connection establishment request packet is transmitted. As shown in steps S16, S17, S18, and S19, the connection establishment request packet returned by the end system 10 is relayed to the end system 12 in step S20 via the relay apparatuses 14-21, 14-22, 14-23, and 14-24. connection is established and data communication is started by the end system 10 on the basis of the connection establishment.

Fig. 7 is a flowchart for the end system process by the connection establishment requesting unit 20 provided for the end system 10 in Fig. 3. In the end

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system process, when the communicating request is issued from the application in step S1, a connection establishing process to the adjacent relay apparatus is executed in step S2. After completion of the connection establishing process, if the negative response packet is received from the adjacent relay apparatus in step S3, a negative response process is If a connection with the end executed in step S4. system of the partner destination is established in step S5, the application is notified of the connection establishment and data communication is performed in If the end of the data communication is step S6. determined in step S7 with respect to the data communication, a process for disconnecting the connection is performed in step S8.

Fig. 8 shows the details of the connection establishing process in step S2 in the end system process in Fig. 7. In the connection establishing process, a status of the relay destination is discriminated in step S1. If the relay destination is normal in step S2, the connection establishment request packet is transmitted to the relay destination in step S3. If the relay destination is abnormal in step S2, another relay destination is selected and the connection establishment request packet is transmitted.

Fig. 9 shows the details of the negative response process in step S4 in the end system process in Fig. 7.

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In the negative response process in the end system, when the negative response packet is received from the relay destination, first, in step S1, the presence or absence of an alternative relay destination of the partner destination end system is discriminated. If there is the alternative relay destination, the status of the relay destination in which the path error occurred is changed to the unusable state in step S2. After that, the alternative relay destination is selected and the connection establishment request packet is transmitted in step S3. A connection with the relay destination is established in step S4. If there is no alternative relay destination in step S1, a path fault is notified to the application in step S5.

Fig. 10 is a flowchart for the relaying process by the connection relay unit 22, connection negative response unit 24, and negative response relay unit 26 of the relay apparatus 14-11 representatively shown in Fig. 3. In the relay process, whether the connection establishment request packet has been received from the end system or another relay apparatus or not is discriminated in step S1. When the packet is received, a connection establishing process is executed in step S2. After completion of the connection establishing process in step S2, if the reception of the negative response packet from the relay destination is decided in step S3, step S4 follows and a negative response

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process is executed. Further, when a connection disconnection packet accompanied by the communication end of the end system is received in step S5, a connection disconnecting process is performed in step S6. Further, when another packet is received in step S7, a process corresponding to the received packet is executed in step S8.

Fig. 11 is a flowchart for the connection establishing process in the relay process in step S2 in Fig. 10. In the connection establishing process in the relay apparatus, a status of the next relay destination is discriminated in step S1. If the relay destination is not abnormal in step S2, the connection establishment request packet of the relay destination is transmitted in step S4. If the relay destination is abnormal, the negative response packet is transmitted to the relay source, thereby disconnecting the connection in step S3.

process in the relay apparatus in step S4 in Fig. 10.

According to the negative response process in the relay apparatus, whether there is an alternative relay destination to the partner destination end system 12 when the negative response packet is received or not is discriminated in step S1. If there is not the alternative relay destination, the presence or absence of the addition of the transfer information by the

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relay apparatus itself is discriminated in step S2. there is the addition, for example, the self IP address is added to the negative response packet as information showing the passage via the relay destination in step The negative response packet is transmitted to the relay source, thereby disconnecting the connection in If the relay apparatus has the alternative relay destination to the partner destination end system in step S1, step S5 follows and a status of the path abnormal relay destination is changed to the unusable After that, the alternative relay destination is selected and the connection establishment request packet is transmitted to another relay destination in Since the relay apparatus at the halfway does step S6. not have two or more relay destinations in the first embodiment of Fig. 1, it is impossible to cope with the switching of the path of the connection establishment request in the relay apparatus in steps S5 and S6. However, if the relay apparatus at the halfway has two or more relay destinations, the connection establishment request can be issued by another path by switching the path in the relay apparatus at the halfway without relaying the negative response packet The second embodiment of the to the end system 10. invention of Fig. 14 copes with the process for switching in the relay apparatuses at the halfway.

Fig. 13 shows the second embodiment of a

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communication system of the invention. Although the connection establishment request for the path fault is switched on the end system 10 side in the first embodiment of Fig. 1, the second embodiment is characterized in that it is switched in the relay apparatus at the halfway. According to a network construction of the second embodiment, the end system 10 has two relay apparatuses 14-11 and 14-21 as relay destinations and, at the same time, each of the relay apparatuses 14-11 and 14-21 also has two relay apparatuses 14-12 and 14-22 as relay destinations.

Fig. 14 is an explanatory diagram of a communicating process in the case where an error occurs in the relay apparatus at the halfway in the second embodiment of Fig. 13. On the basis of the communicating request of the application of the end system 10, the end system 10 transmits a connection establishment request packet 53 to the adjacent relay The connection establishment request apparatus 14-11. packet 53 is relayed to the relay apparatuses 14-12 and 14-13. However, when it is relayed to the relay apparatus 14-13, the relay apparatus 14-13 recognizes an error of the next relay apparatus 14-14 and transmits a negative response packet 54 to the relay The packet 54 is further transmitted apparatus 14-12. from the relay apparatus 14-12 to the relay apparatus The relay apparatus 14-11 which received the 14-11.

negative response packet 54 has the relay apparatus 14-22 as an alternative relay apparatus besides the relay apparatus 14-12 as a path fault relay destination. Therefore, after the status of the relay apparatus 14-12 is changed to the unusable state, a connection establishment request packet 56 is retransmitted to the relay apparatus 14-22 as an alternative destination. The connection establishment request packet 56 is relayed by the relay apparatuses 14-23 and 14-24 and finally relayed to the end system 12. Thus, a TCP connection via the relay apparatuses 14-11, 14-22, 14-23, and 14-24 from the end system 10 is established and data communication from the end system 10 is started.

Figs. 15A, 15B, and 15C are time charts showing the details of the communicating process for switching in the relay apparatuses at the halfway in Fig. 14.

First, when the application of the end system 10 of the communicating source issues the communicating request, a status of the adjacent relay apparatus 14-11 is discriminated in step S1. Since it is normal, the connection establishment request packet is transmitted. The relay apparatus 14-11 discriminates a status of the next relay apparatus 14-12 in step S2. Since it is normal, the connection establishment request packet is similarly transmitted. Similarly, the relay apparatus 14-12 discriminates a status of the next relay apparatus 14-13 in step S3. Since it is normal, the

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connection establishment request packet is transmitted. The relay apparatus 14-13 discriminates a status of the next relay apparatus 14-14 when the packet is received. In this case, since the relay apparatus 14-14 is abnormal, the processing routine advances to step S5. The error contents of the relay apparatus 14-14 are set into the negative response packet. In step S6, the negative response packet is transmitted to the relay apparatus 14-12 of the relay source, thereby disconnecting the connection. The relay apparatus 14-12 discriminates the presence or absence of an alternative relay apparatus for the end system 12 in step S7. Since there is no alternative relay apparatus in this case, the presence or absence of the addition of the transfer information is discriminated in step If there is the addition, the self IP address via the relay apparatus 14-12 is added in step S9. After that, the negative response packet is transmitted to the relay apparatus 14-11, thereby disconnecting the The relay apparatus 14-11 discriminates connection. the presence or absence of an alternative relay apparatus for the end system 12 in step S11. Since there is the alternative relay apparatus 14-22 in this case, the status of the relay apparatus 14-12 in which the path fault occurred is changed to the unusable state in step S11. After that, the relay apparatus 14-22 as an alternative relay apparatus is selected in

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step S12 and the connection establishment request packet is transmitted. Therefore, the connection establishment request packet switched by the relay apparatus 14-11 passes through the relay apparatuses 14-22, 14-23, and 14-24 as shown in steps S13, S14, and S15 and, thereafter, is relayed to the end system 12. A connection is established in step S16, so that data communication from the end system 10 of the communicating source is started.

Fig. 16 shows the third embodiment of a communication system according to the invention. According to the third embodiment, since relay functions are multiplexed and provided for the relay apparatus provided adjacently to the end system 10, the end system has a plurality of relay destinations. relay apparatus 15 adjacent to the end system 10 has, for example, relay adapters 50-1 and 50-2. Each of the relay adapters 50-1 and 50-2 is constructed by hardware as an individual processing apparatus and has an independent IP address. By collectively providing a virtual IP address for such two relay adapters 50-1 and 50-2, those adapters are installed as one relay apparatus 15. By providing the relay adapters 50-1 and 50-2 having a function as, for example, two gateways for performing a TCP relay into the relay apparatus 15 as mentioned above, for example, when the end system 10 receives the negative response packet due to the path

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fault on the relay adapter 50-1 side, the relay adapter 50-2 of the relay apparatus 15 serving as an alternative relay destination is selected and the connection establishment request packet is retransmitted, thereby enabling a TCP connection to be established between the relay apparatus 15 and end system 12 by a path of the other relay apparatuses 14-21 to 14-2n.

Fig. 17 shows the fourth embodiment of a communication system according to the invention. The relay apparatus 15 adjacent to the end system 10 has, for example, two relay adapters 50-1 and 50-2 in a manner similar to the third embodiment of Fig. 16. addition to them, according to the fourth embodiment, further, internal information can be exchanged between the relay adapters 50-1 and 50-2 by a transmission path Since the relay apparatus 15 has the relay adapters 50-1 and 50-2 connected by the transmission path 52 which can exchange the internal information as mentioned above, for example, when the end system 10 selects the relay adapter 50-1 and issues the connection establishment request, a path fault occurs at the halfway, and when the negative response packet for the path fault is received by the relay adapter 50-1, the relay adapter 50-1 instructs the relay adapter 50-2 to switch the connection establishment request by the transmission of the internal information via the

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transmission path 52. Therefore, the connection establishment request to the end system 12 can be issued again by the path passing through the relay apparatus 14-21 from the relay adapter 50-2 serving as another relay destination in the relay apparatus 15 at the foreground without switching the connection establishment request on the end system 10 side. In this case, the relay adapter 50-1 transmits the internal information to the relay adapter 50-2 by the transmission path 52 and issues the connection establishment request again to another relay destination. After that, the negative response packet is transmitted to the end system 10. The end system 10 changes a status of the relay adapter 50-1 in which the fault occurred from the negative response packet to an Therefore, when the next and unusable state. subsequent communicating requests are issued, the end system 10 selects the relay adapter 50-2 side in the relay apparatus 15 and issues the connection establishment request.

Fig. 18 shows the fifth embodiment of a communication system according to the invention.

According to the fifth embodiment, a relay apparatus

15-1 adjacent to the end system 10 of the communicating source has relay adapters 50-11 and 50-21 and a transmission path 52-1 for transmitting internal information. In addition to them, a relay apparatus

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15-2 is also provided adjacently to the end system 12 of the communicating destination. The relay apparatus 15-2 has two relay adapters 50-12 and 50-22, thereby enabling the internal information to be mutually transmitted and received by a transmission path 52-2. As mentioned above, the relay apparatuses 15-1 and 15-2 having a plurality of relay apparatuses and a switching system for transmitting the internal information are provided adjacently to the end systems 10 and 12 for performing data communication, respectively. Therefore, when the connection establishment request is issued from the end system 10, a path fault occurs and the path can be switched. At the same time, on the contrary, with respect to the connection establishment request by the communicating request from the end system 12 side, a connection can be established by switching the path to another path for the same path Thus, in a case where the communicating requests are mutually issued between the end systems 10 and 12, a connection can be certainly established by another path which avoids the path fault. Even if there is a path fault, data communication can be started in a short time.

According to the invention as mentioned above,
when a connection via a plurality of relay apparatuses
is established between the end system of the
communicating source and the end system of the

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communicating destination and data is communicated, even if the establishment of the connection fails due to an error of the relay apparatus at the halfway or the like, the negative response packet is returned to the end system of the communicating source as soon as the error occurs and the path fault is recognized. When the path fault is recognized, a connection via another relay apparatus is established without notifying the application of the path fault. A connection to the partner destination end system in which a fault path is avoided can be established in a short time and data communication (business) can be started. When a path fault due to an error of the relay apparatus is detected at the time of establishment of the connection from the end system, a connection via another communication path can be established in a real-time manner and communication can Therefore, even in case of switching a be started. multiplexed large-scale network such as Internet, provider, or the like, there is no need to monitor a fault through the end system of the partner destination. Further, since the detection of the path fault and the switching can be performed by using only the packet which is used for communication, a special mechanism such as a ping for monitoring a fault is not particularly necessary. A load of the network and a burden on the end system and relay apparatuses can be

reduced for this reason. Naturally, by combining the invention with the fault monitoring function such as a ping or the like, wasteful retransmission of the data communication and vain connection delay can be avoided owing to the fault monitor and path switching according to the invention during a period of time until a result of the monitor which is performed every predetermined time is reflected to routing information. Further, by the relay of the negative response at the time of detection of the path error, in which relay apparatus and by which reasons the connection has been refused can be recognized on the end system side. It is possible to promptly and properly take a countermeasure such as recovery, repair, or the like against the path fault.

Although the path can be switched at the positions of the relay apparatuses adjacent to the end systems 10 and 12 in the foregoing embodiments, the arranging positions of the relay apparatuses for performing the path switching are not necessarily limited to the positions adjacent to the end systems. If a plurality of relay destinations are provided at the stage of the proper relay apparatus provided at the halfway of the network, it is possible to select another relay destination for the path fault and switch the path at this portion. The present invention incorporates many proper variations and modifications without losing the

objects and advantages of the invention. Further, the invention is not limited by the numerical values shown in the embodiments.